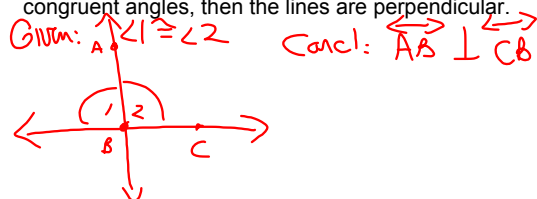


## 3.6 Prove Theorems about Perpendicular Lines

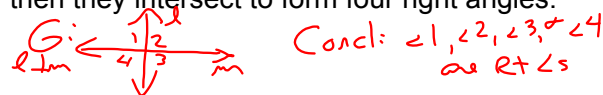
## Notes

Several theorems about perpendicular lines

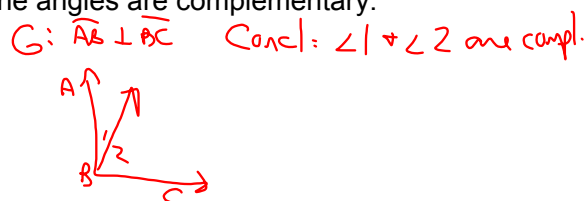
Theorem 3.8—If 2 lines intersect to form a linear pair of congruent angles, then the lines are perpendicular.



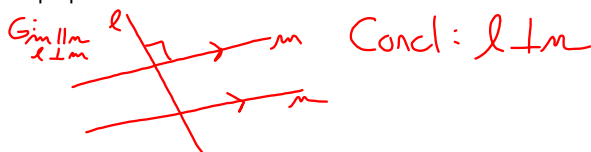
Theorem 3.9—If 2 lines are perpendicular, then they intersect to form four right angles.



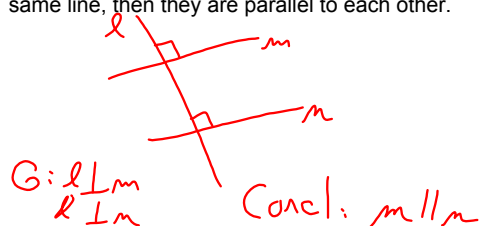
The Complement Theorem—If 2 sides of 2 adjacent acute angles are perpendicular, then the angles are complementary.



Theorem 3.11—Perpendicular Transversal Theorem—If a transversal is perpendicular to one of two parallel lines, then it is perpendicular to the other.



Theorem 3.12—Lines Perpendicular to a Transversal Theorem—In a plane, if two lines are perpendicular to the same line, then they are parallel to each other.



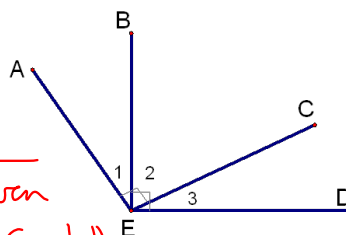
Example:

Given:  $\overline{AE} \perp \overline{EC}$ ;  $\overline{BE} \perp \overline{ED}$

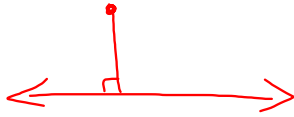
Prove:  $\angle 1 \cong \angle 3$

Statements      Reasons

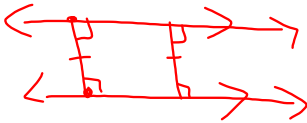
- |                                    |                     |
|------------------------------------|---------------------|
| ① $\sim$                           | ① Given             |
| ② $\angle 1 + \angle 2$ are compl. | ② The Compl thm     |
| ③ $\angle 2 + \angle 3$ are compl. |                     |
| ④ $\angle 1 \cong \angle 3$        | ③ $\cong$ Compl thm |



Distance from a point to a line—the length of the perpendicular segment from the point to the line.



The distance between 2 parallel lines is the length of any perpendicular segment joining the 2 lines.

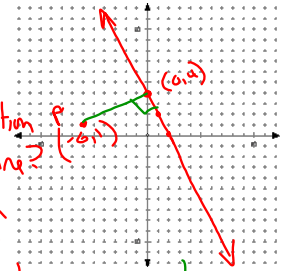


Examples:

Find the distance between the point and the line listed.

Ex 1:  $(-6, 1)$  and  $y = -2x + 4$

- ① Sketch
- ② What is the intersection of  $\perp$  segment & the line?
- ③ Find the equation of the line that contains  $\perp$  segment
- ④ Solve the system
- ⑤ Use distance formula

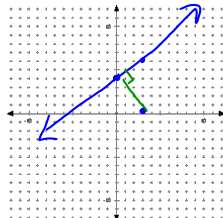


$$\begin{aligned} & (-6, 1) \quad (0, 4) \\ d &= \sqrt{(-6-0)^2 + (1-4)^2} \\ &= \sqrt{36 + 9} \\ &= \sqrt{45} \\ d &= 3\sqrt{5} \text{ units} \\ d &\approx 6.71 \text{ units} \end{aligned}$$

$$\begin{aligned} m &= \frac{1}{2} \\ (-6, 1) \\ y &= \frac{1}{2}x + 4 \\ y &= -2x + 4 \\ \frac{1}{2}x + 4 &= -2x + 4 \\ 2\frac{1}{2}x &= 0 \\ x &= 0 \\ (0, 4) \end{aligned}$$

Ex 2:  $(3, 0)$  and  $y = \frac{2}{3}x + 4$

$$\begin{aligned} m &= -\frac{3}{2} \\ y &= -\frac{3}{2}x + b \\ 0 &= -\frac{3}{2}(3) + b \\ \frac{9}{2} &= b \end{aligned}$$



$$\begin{cases} y = -\frac{3}{2}x + \frac{9}{2} \\ y = \frac{2}{3}x + 4 \end{cases}$$

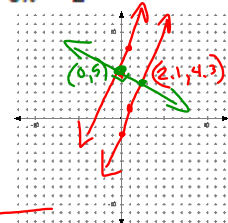
$$\begin{aligned} \left[ -\frac{3}{2}x + \frac{9}{2} = \frac{2}{3}x + 4 \right] & \quad y = \frac{2}{3}\left(\frac{3}{13}\right) + 4 \\ -\frac{3}{2}x + \frac{9}{2} &= \frac{2}{3}x + 4 \\ -9x + 27 &= 4x + 24 \\ 3 &= 13x \\ \frac{3}{13} &= x \end{aligned}$$

$$\begin{aligned} d &= \sqrt{\left(3 - \frac{3}{13}\right)^2 + \left(0 - \frac{54}{13}\right)^2} \\ &= \sqrt{\frac{1296}{169} + \frac{2916}{169}} \\ &= \sqrt{\frac{3212}{169}} \\ &= \frac{\sqrt{3212}}{13} \\ &\approx 4.99 \text{ units} \end{aligned}$$

Find the distance between the two parallel lines.

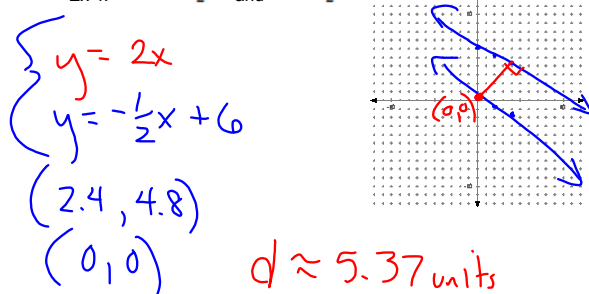
Ex 3:  $y = 3x + 5$  and  $y = 3x - 2$

$$\begin{aligned} y &= -\frac{1}{3}x + 5 \\ y &= 3x - 2 \end{aligned}$$



$$\begin{aligned} d &= \sqrt{(2.1-0)^2 + (4.3-5)^2} \\ d &\approx 2.21 \text{ units} \end{aligned}$$

Ex 4:  $y = \frac{-1}{2}x$  and  $y = \frac{-1}{2}x + 6$



Find the equation of the perpendicular bisector of the segment with the given endpoints.

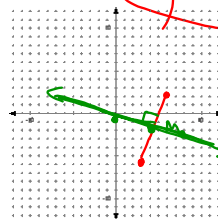
Ex 5:  $(5, 2)$   $(3, -6)$

$m = \frac{2 - (-6)}{5 - 3} = 4$   
 $m = -\frac{1}{4}$

Midpt  
 $\frac{5+3}{2}$   $\frac{2+(-6)}{2}$   
 $M(4, -2)$

$y = -\frac{1}{4}x - 1$

$y = -\frac{1}{4}x + b$   
 $-2 = -\frac{1}{4}(4) + b$   
 $-1 = b$



Ex 6:  $(-3, 7)$   $(8, -5)$

HW p194-195 #s 1-7, 13-17  
and find the distance between

$y = -2x + 4$

$y = -2x - 5$

Test \_\_\_\_\_!

## 3.6 day 2 assignment

1. Find the distance between:

$$y = -2x - 5 \quad y = -2x + 4$$

2. Find the distance between:

$$y = 1.5x + 4 \quad y = 1.5x - 0.5$$

3. Parallelogram ABCD A(-4, -1) B(2, 3)  
C(7, 2) D(1, -2) Find the distance between  
the parallel sides.

4. Find the equation of the perpendicular  
bisector of  $\overline{AB}$  A(0, 2) B(4, 7)